

8. **The response does not adequately answer question 18 in MDE's May 7, 2007 letter, especially regarding short-term and long-term impacts on water quality and aquatic biota. Further, your assertion that the dredging will improve water circulation and dissolved oxygen levels is not substantiated by modeling or other hydrologic data.**

**Response:**

AES understands from the question posed above that MDE desires more information than previously provided by AES in its response to MDE's May 7, 2007 Data Request 18 concerning short-term and long-term impacts on water quality and aquatic biota associated with the dredging proposed by AES. The additional information requested, and additional substantiation of AES's assertion that the dredging will improve conditions for water circulation and dissolved oxygen levels, is provided below.

Predicted Short-Term Impacts to Water Quality and Aquatic Biota

The potential short-term impacts to water quality from dredging activities typically involve the following:

- Turbidity; and
- Resuspension of contaminants sorbed to sediment particles.

The potential short-term impacts to aquatic biota typically include the following:

- Disturbance/removal of established sediment habitat;
- Disturbance/removal of established benthic macroinvertebrate communities;
- Disturbance/loss of aquatic vegetation;
- Disturbance/degradation of nearby habitat through transport and sedimentation of suspended particles; and
- Disruption of migration/foraging by fish.

In its response to MDE's May 7, 2007 Data Request 18, using information from the biologic surveys completed at the Project Site, AES noted that there is no submerged aquatic vegetation ("SAV") in the area proposed to be dredged by AES; thus, there will be no direct impacts to this resource due to disturbance/removal or disturbance/loss (i.e., the first three bullet points under potential impacts to aquatic biota).

To minimize potential transport and sedimentation impacts to water quality and aquatic biota to the greatest extent feasible, AES has proposed to make use of techniques that will greatly reduce the release of suspended sediments into the water column within and adjacent to the construction site. Specifically, the use of an environmental dredging bucket (or suitable alternative) may be used to remove the upper surface layers of sediments that, based on significant sampling performed in this area to date, appear to contain higher concentrations of contaminants than sediments at lower depths. As described in the reference document included with the response to MDE's May 7, 2007 Data Request 18, compared to the conventional clamshell bucket, this type of dredging bucket has been

shown to reduce sediment leaks (and therefore associated turbidity) within the work area, by approximately 75 percent (ACOE, 2001). The use of an environmental dredging bucket will produce similar reductions of sediment-bound contaminants in the water column during dredging. Techniques that improve the use of the environmental dredge bucket include, but are not limited to: GPS location of the dredge lines and dredge positioning to avoid overdredge and precise placement and depth of the bucket; speed controls on both lowering and raising of the bucket to minimize release of sediment from the bucket; and electronic controls on closure and sealing of the bucket to limit water (as opposed to sediment) uptake in the bucket. Note that these techniques have not been used by dredge operations at this same location and nearby areas in past ACOE and Maryland permitted dredging; therefore, the proposed dredging will be taking control steps beyond those used with other projects here in the past.

Water quality impacts associated with suspended sediment are also possible if contaminants preferentially leach to the water column from exposed contaminated dredge material. Elutriate testing of sediment to be dredged for this project was performed, and those results also provided to MDE in AES's Resource Report 2, *Water Use and Quality*, and in the CFRA application package. This testing has shown that minimal water quality impacts may be possible from only two heavy metal contaminants that were detected slightly above water quality standards. This indicates that very limited impacts may be possible in the short term; i.e., the time frame during dredging when sediment is actively disturbed and contaminated sediment may dynamically come in contact with the water column. Once dredging is complete in an area, suspended sediment resettles, re-equilibrates with sediment pore water, and the potential for release of contaminants that may remain to the pore water becomes limited. Thus, no other short and no long term water quality impacts would be anticipated.

Disturbance and degradation (through transport and sedimentation of suspended particles) of established benthic habitat and invertebrate communities is unavoidable in any dredging operation, whether intended for navigational or remedial purposes. The Maryland Department of the Environment (2004) has determined that "Navigation Channel" status is applicable to the dredged portions of the river extending from the mouth of the Patapsco River (confluence with Chesapeake Bay) to Curtis Bay and Creek, and the Middle and Northwest Branches. A "Navigation Channel" designation acknowledges the instability of the benthic community within outer and inner deep-dredged channel areas due to the historic dredging activities associated with the Harbor. In such areas, opportunistic species generally comprise the benthic community. New disturbances in areas such as proposed to be dredged by AES, i.e., those designated as a "Navigation Channel" because they are unstable and periodically disturbed, will result in recolonization by the same type of opportunistic species as existed immediately prior to the disturbance. Where recolonization of disturbed areas occurs, it would take place within short timeframes. The techniques described above for minimization of suspended particles will ensure that even these expected short term impacts are reduced to the greatest extent feasible.

As stated in the original response to MDE's May 7, 2007 Data Request 18, it is anticipated that there will be no negative sedimentation impacts in areas located more than 1,200 feet from the dredge activities, and impacts that may exist would diminish with distance from the dredge activities. Importantly, the Fort Carroll oyster restoration project that is located about 1,500 feet away from the closest area proposed to be dredged (west northwest from the approach channel) would not be impacted by the dredging proposed by AES. In this regard, consultation with NMFS is ongoing and AES has requested the concurrence of NMFS regarding the anticipated impacts of the dredging

activity on the Fort Carroll oyster reef restoration project.

Finally, construction will be scheduled such that short-term impacts to fish known to migrate through these waterways should be minimal.

#### Predicted Long-Term Impacts to Water Quality and Aquatic Biota

There are two general categories of long-term impacts to water quality and aquatic biota to be considered for this project:

- Cumulative effects of short-term impacts caused by repeated maintenance dredging; and
- Impacts resulting from permanent changes affecting water movement and/or sediment and contaminant loadings.

The approach channel and turning basin associated with the LNG Terminal are estimated to require maintenance dredging approximately 500,000 cubic yards of dredged material every six years. As a result of the mitigation of short-term impacts described above, there are no expected long-term cumulative impacts resulting from maintenance dredging. The lack of impacts associated with permanent changes affecting water movement and/or sediment and contaminant loadings are described below.

#### Water Circulation

The proposed dredging may affect water movement at the seafloor in the vicinity of the LNG Terminal. Although channel deepening may create opportunity for vertical stratification, the connection of the approach channel and the turning basin is better expected to create an avenue for circulation of the deeper water within the vicinity of the LNG Terminal that does not currently exist (past bathymetry submitted to MDE associated with the AES dredge permit application clearly shows deeper bathymetric “pockets” within the Sparrows Point waterfront area and marine channel than the portion of the channel that connects to the Brewerton Angle main deep channel within the Patapsco River). The rationale for the expectation that the deepening will create an avenue for better circulation of the water is set forth below.

Circulation patterns in the Chesapeake Bay are typically characterized by the two-layer circulation model (see Li et al., 2005) where surface flows are “outflows” (i.e., away from Baltimore City toward and down the Chesapeake Bay), and near-bed flows are “inflows” (i.e., toward Baltimore City from the Chesapeake Bay), with no flow in the middle layer. The density stratification present in this flow pattern typically prevents circulation between the surface and near-bed layers. As early as 1960, Baltimore Harbor has been documented to sometimes demonstrate a unique 3-layer density-driven circulation pattern (see Chao et al., 1996). This pattern consists of “inflows” in the surface and near-bed layers, and an “outflow” in the middle layer. This flow pattern promotes mixing between the surface and near-bed layer. This pattern would be inhibited by the presence of bathymetric barriers that disconnect the deeper, near-bed inflow pattern, as are currently shown to be present in the Sparrows Point bathymetry. Therefore, it is concluded that deepening the approach channel to the depth of the turning basin will provide bathymetry better suited to a consistent (rather than interrupted) flow pattern. This would foster a similar 3-layer density-driven circulation pattern, which would reduce the likelihood of seasonal stratification in the deeper areas.

### Dissolved Oxygen

Considerable water quality data have been collected within the Baltimore Harbor and Patapsco River. Existing conditions within Baltimore Harbor and Patapsco River have warranted a low Index of Biological Integrity (“IBI”) rating. Very low dissolved oxygen (“DO”) levels have been attributed to weak circulation patterns and the presence of pollutants from upland sources (e.g., phosphorous and nitrogen), and chemical contaminants within the upper surface layers of the sediments from a variety of potential sources, including wastewater discharges and nutrient loadings. Low DO levels are most pronounced during summer months and within deep water areas.

The proposed dredging will reduce the mass of sediment-bound chemical contaminants in contact with surface water. These sediment-bound contaminants (e.g., phosphorus and nitrogen from upland sources and compounds such as polycyclic aromatic hydrocarbons (“PAHs”) detected in sampling performed for the proposed dredging project), that are documented in materials supplied by AES to MDE and in historical studies conducted in other parts of the Patapsco River and Baltimore Harbor), have a propensity to combine with oxygen, thus removing the oxygen from the water. Any removal of these oxygen-combining contaminants will produce a positive impact on the levels of DO because those contaminants will not be present to combine with and consume the DO. Importantly, the depth to which AES has proposed to dredge is generally below the level at which contamination exists (the level of contamination decreases with depth in the sediment column). Thus, not only will large volumes of contaminated sediments be removed from the system, including their associated chemical oxygen demand, but sediment that is generally free of contaminants or is native sediment will be exposed. The native sediments do not contain the oxygen-demanding contaminants that currently exist in the surficial sediments.

The issues of water circulation and the levels of DO are also linked. As described in Resource Report 2, *Water Use and Quality*, shallower sediment areas currently exist between the outflow area of the Sparrows Point Marine Channel to the Patapsco River and Baltimore Harbor, which tend to prevent water circulation between the Sparrows Point waterfront and the deeper water located within Patapsco River. Water depth in the drydock area is approximately 40 to 45 feet deep, but is cut off from deeper areas of the Patapsco River and Chesapeake by the shallower shipping channel that has an approximate depth of 25 to 30 feet. The proposed dredging will deepen the channel. This provides the physical setting, not currently present, to allow increased flow and circulation between the two waterbodies, thereby potentially improving DO levels.

### Expected Project Compliance with Use 1 DO Requirements and Turbidity Limits

DO concentrations are currently being monitored at a site located on the Patapsco River at the Fort McHenry wetland restoration site in Baltimore, Maryland. Continuous monitoring data are being collected and managed at this site by the Maryland Department of Natural Resources. DO and turbidity data available for August 1 through August 7, 2007 were reviewed (Maryland Department of Natural Resources, 2007). In general, the DO values varied widely throughout a 24-hour period with lower DO levels (less than 3.4 mg/l) observed for the late evening and early morning hours (9:00 PM to 7:00 AM). The average for the remainder of the day (7:15 AM to 8:45 PM) was 7.32 mg/l. The cumulative DO average for the entire dataset was 5.65 mg/l. Turbidity data values were generally higher during the afternoon and evening hours (12 PM – 10 PM). The turbidity average

for this time frame is 9.75 NTUs and 6.41 NTUs for the rest of the day. The cumulative turbidity average for the entire data set was 7.84 NTUs. These values are summarized in the table below.

**Table 1. Average Dissolved Oxygen and Turbidity levels for the Patapsco River – Baltimore Harbor, Maryland Monitoring Station. August 1 2007 through August 8, 2007**

Average Dissolved Oxygen (mg/l)			Average Turbidity (NTUs)		
9 PM–7 AM	7:15 AM–8:45 PM	Cumulative Average <sup>1</sup>	12 PM–10 PM	12:15 PM–9:45 PM	Cumulative Average <sup>1</sup>
3.38	7.32	5.65	9.75	6.41	7.84
<sup>1</sup> Cumulative average for the time frame of 7:45 AM August 1, 2007 through 7:45 AM August 8, 2007 Source: Maryland Department of Natural Resources, 2007.					

Historic DO data (1992–1997) show that anoxic conditions (at or near 0 mg/l) have existed in the past within bottom layers of the mouth, inner harbor, and channel of Baltimore Harbor during the summer months (Maryland Department of the Environment, 2004). Data entered into modeling scenarios projected that non-attainment of DO requirements occur 77% of the time for the period of June 1 through September 30 within the deep channel areas of the Patapsco River mesohaline region, primarily because of hydrological modifications authorized by the Federal Rivers and Harbors Act and a complex tidal circulation that results in the transfer of hypoxic and anoxic waters from the main channels of the bay into the Patapsco River. The Use Attainability Analysis determined that a “Navigation Channel” status be designated for the dredged portions of the river extending from the mouth of the Patapsco River (confluence with Chesapeake Bay) to Curtis Bay and Creek, and the Middle and Northwest Branches. As a result of these actions, the DO requirement for these areas was set at 0 mg/l for the period of June 1 through September 30.

The Patapsco River and Baltimore Harbor are designated as Use 1 waterbodies. Current state water quality standards for Use 1 waters are set at a minimum of 5 mg/l for dissolved oxygen and a maximum of 150 NTUs for turbidity (COMAR 26.08.02.03-3). Through implementation of the proposed dredging techniques and anticipated construction timelines discussed previously, it is expected that the Project-related activities will be in compliance with these water quality standards.

In summary, the proposed dredging has been planned using sampling data to demonstrate that water quality impacts, to the extent they may occur, will be minimal in the short term associated with the dredging and are not anticipated long term (removal of contaminated sediment from the system is anticipated to improve baseline conditions affecting water quality). Disturbance of benthic habitats within the dredged area will occur; however, as documented through biologic survey of the area, there is no SAV present that would be affected and the habitat present is primarily soft sediment affected by past and current permitted maintenance dredging. The area is colonized by opportunistic species which are expected to recolonize quickly following dredging. The dredging will create bathymetry that will be better suited to a consistent (rather than interrupted) flow pattern. This pattern, and removal of contaminated sediment (which generates chemical oxygen demand), will improve conditions for deep water DO levels to be maintained at or above the designated criteria for the Patapsco.

Maryland Department of Natural Resources. 2007. Continuous Monitoring – Current Results. Patapsco River – Baltimore Harbor. Retrieved August 24, 2007 from: [http://mddnr.chesapeakebay.net/newmontech/contmon/current\\_results\\_data.cfm?station=McHenry&choose\\_date=15296&choose\\_range=7](http://mddnr.chesapeakebay.net/newmontech/contmon/current_results_data.cfm?station=McHenry&choose_date=15296&choose_range=7)

U.S. Army Corps of Engineers. 2001. Dredge bucket comparison demonstration at Boston Harbor. Coastal and Hydraulic Engineering Technical Note VI-35. Retrieved August 24, 2007 from: <http://chl.erdc.usace.army.mil/library/publications/chetn/pdf/chetn-vi-35.pdf>

Maryland Department of the Environment. 2004. Use Attainability Analysis for the federal navigation channels located in tidal portions of the Patapsco River. Retrieved August 24, 2007 from: [http://www.mde.state.md.us/assets/document/wqstandards/UAA\\_patapsco.pdf](http://www.mde.state.md.us/assets/document/wqstandards/UAA_patapsco.pdf)

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AES Sparrows Point LNG, LLC and Mid-Atlantic Express, LLC  
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within the dredged area will occur; however, as documented through biologic survey of the area, there is no SAV present that would be affected and the habitat present is primarily soft sediment affected by past and current permitted maintenance dredging. The area is colonized by opportunistic species which are expected to recolonize quickly following dredging. The dredging will create bathymetry that will be better suited to a consistent (rather than interrupted) flow pattern. This pattern, and removal of contaminated sediment (which generates chemical oxygen demand), will improve conditions for deep water DO levels to be maintained at or above the designated criteria for the Patapsco.

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